

1. For the scenario below, model the rate of vibration (cm/s) of the string in terms of the length of the string. Then determine the variation constant  $k$  of the model (if possible). The constant should be in terms of cm and s.

*The rate of vibration of a string under constant tension varies based on the type of string and the length of the string. The rate of vibration of string  $\omega$  increases as the quartic length of the string decreases. For example, when string  $\omega$  is 4 mm long, the rate of vibration is 31 cm/s.*

- A.  $k = 7936.00$
- B.  $k = 0.12$
- C.  $k = 0.79$
- D.  $k = 1210.94$
- E. None of the above.

- 
2. Choose the model type that would best describe the scenario below.

*Big O notation is common in computer science to describe how fast a program can solve a particular problem. Big O notation categorizes functions according to their growth rates, the same way we have categorized modeling real-world problems by certain types of functions. When analyzing a particular program, a student found the computer to need  $x^x$  time to complete, where  $x$  was the number of inputs into the program.*

- A. Indirect variation
- B. Joint variation
- C. Direct variation
- D. None of the above

- 
3. For the scenario below, find the variation constant  $k$  of the model (if possible).

*In an alternative galaxy, the quartic of the time,  $T$  (Earth years), required for a planet to orbit Sun  $\chi$  increases as the square of the distance,  $d$  (AUs), that the planet is from Sun  $\chi$  increases. For example, when Ea's average distance from Sun  $\chi$  is 2, it takes 100 Earth days to complete an orbit.*

- A.  $k = 2.236$
  - B.  $k = 25000000.000$
  - C.  $k = 4.028$
  - D.  $k = 400000000.000$
  - E. Unable to compute the constant based on the information given.
- 

4. For the scenario below, use the model for the volume of a cylinder as  $V = \pi r^2 h$  to find the coefficient for the model of the new volume  $V_{\text{new}} = kr^2 h$ .

*Pepsi wants to increase the volume of soda in their cans. They've decided to decrease the radius by 12 percent and increase the height by 10 percent. They want to model the new volume based on the radius and height of the original cans.*

- A.  $k = 0.85184$
  - B.  $k = 0.00144$
  - C.  $k = 0.00452$
  - D.  $k = 2.67613$
  - E. None of the above.
- 

5. For the scenario below, model the rate of vibration (cm/s) of the string in terms of the length of the string. Then determine the variation constant  $k$  of the model (if possible). The constant should be in terms of cm and s.

*The rate of vibration of a string under constant tension varies based on the type of string and the length of the string. The rate of vibration*

*of string  $\omega$  increases as the cube length of the string decreases. For example, when string  $\omega$  is 5 mm long, the rate of vibration is 34 cm/s.*

- A.  $k = 0.27$
- B.  $k = 272.00$
- C.  $k = 4.25$
- D.  $k = 4250.00$
- E. None of the above.

- 
6. For the scenario below, use the model for the volume of a cylinder as  $V = \pi r^2 h$  to find the coefficient for the model of the new volume  $V_{\text{new}} = kr^2 h$ .

*Pepsi wants to increase the volume of soda in their cans. They've decided to decrease the radius by 13 percent and increase the height by 14 percent. They want to model the new volume based on the radius and height of the original cans.*

- A.  $k = 0.86287$
- B.  $k = 0.00743$
- C.  $k = 2.71077$
- D.  $k = 0.00237$
- E. None of the above.

- 
7. For the scenario below, find the variation constant  $k$  of the model (if possible).

*In an alternative galaxy, the cube of the time,  $T$  (Earth years), required for a planet to orbit Sun  $\chi$  increases as the cube of the distance,  $d$  (AUs), that the planet is from Sun  $\chi$  increases. For example, when Ea's average distance from Sun  $\chi$  is 6, it takes 76 Earth days to complete an orbit.*

- A.  $k = 94818816.000$

- B.  $k = 2.331$
  - C.  $k = 2032.296$
  - D.  $k = 4.028$
  - E. Unable to compute the constant based on the information given.
- 

8. Choose the model type that would best describe the scenario below.

*In economics, there are two common equations to model interest earned. The compound interest formula is  $A = P(1 + \frac{r}{n})^{nt}$ , where  $A$  is the amount of money you end up with,  $P$  is your starting money,  $r$  is the interest rate,  $n$  is the number of times compounded in a year, and  $t$  is the total number of years. For example, if you were a parent and wanted to save \$10,000 in 3 years-time at 3.5% interest compounded monthly, you would need to invest about \$9,000.*

- A. Indirect variation
  - B. Joint variation
  - C. Direct variation
  - D. None of the above
- 

9. A town has an initial population of 40000. The town's population for the next 9 years is provided below. Which type of function would be most appropriate to model the town's population?

Year	1	2	3	4	5	6	7	8	9
Pop	39920	39680	38720	34880	19520	0	0	0	0

- A. Logarithmic
- B. Non-Linear Power
- C. Linear
- D. Exponential
- E. None of the above

- 
10. A town has an initial population of 70000. The town's population for the next 9 years is provided below. Which type of function would be most appropriate to model the town's population?

Year	1	2	3	4	5	6	7	8	9
Pop	70040	70080	70160	70320	70640	71280	72560	75120	80240

- A. Non-Linear Power
  - B. Exponential
  - C. Linear
  - D. Logarithmic
  - E. None of the above
- 

11. For the scenario below, model the rate of vibration (cm/s) of the string in terms of the length of the string. Then determine the variation constant  $k$  of the model (if possible). The constant should be in terms of cm and s.

*The rate of vibration of a string under constant tension varies based on the type of string and the length of the string. The rate of vibration of string  $\omega$  decreases as the cube length of the string increases. For example, when string  $\omega$  is 4 mm long, the rate of vibration is 38 cm/s.*

- A.  $k = 2432.00$
  - B.  $k = 593.75$
  - C.  $k = 2.43$
  - D.  $k = 0.59$
  - E. None of the above.
- 

12. Choose the model type that would best describe the scenario below.

*Big O notation is common in computer science to describe how fast a program can solve a particular problem. Big O notation categorizes*

*functions according to their growth rates, the same way we have categorized modeling real-world problems by certain types of functions. When analyzing a particular program, a student found the computer to need  $x^x$  time to complete, where  $x$  was the number of inputs into the program.*

- A. Joint variation
- B. Direct variation
- C. Indirect variation
- D. None of the above

- 
13. For the scenario below, find the variation constant  $k$  of the model (if possible).

*In an alternative galaxy, the quartic of the time,  $T$  (Earth years), required for a planet to orbit Sun  $\chi$  decreases as the quartic of the distance,  $d$  (AUs), that the planet is from Sun  $\chi$  decreases. For example, when Ea's average distance from Sun  $\chi$  is 8, it takes 83 Earth days to complete an orbit.*

- A.  $k = 194389282816.000$
- B.  $k = 11586.504$
- C.  $k = 1.795$
- D.  $k = 4.028$
- E. Unable to compute the constant based on the information given.

- 
14. For the scenario below, use the model for the volume of a cylinder as  $V = \pi r^2 h$  to find the coefficient for the model of the new volume  $V_{\text{new}} = kr^2 h$ .

*Pepsi wants to increase the volume of soda in their cans. They've decided to decrease the radius by 10 percent and decrease the height by 12 percent. They want to model the new volume based on the radius and height of the original cans.*

- A.  $k = 0.00377$
  - B.  $k = 0.00120$
  - C.  $k = 0.71280$
  - D.  $k = 2.23933$
  - E. None of the above.
- 

15. For the scenario below, model the rate of vibration (cm/s) of the string in terms of the length of the string. Then determine the variation constant  $k$  of the model (if possible). The constant should be in terms of cm and s.

*The rate of vibration of a string under constant tension varies based on the type of string and the length of the string. The rate of vibration of string  $\omega$  decreases as the quartic length of the string increases. For example, when string  $\omega$  is 2 mm long, the rate of vibration is 38 cm/s.*

- A.  $k = 0.06$
  - B.  $k = 2.38$
  - C.  $k = 608.00$
  - D.  $k = 23750.00$
  - E. None of the above.
- 

16. For the scenario below, use the model for the volume of a cylinder as  $V = \pi r^2 h$  to find the coefficient for the model of the new volume  $V_{\text{new}} = kr^2 h$ .

*Pepsi wants to increase the volume of soda in their cans. They've decided to decrease the radius by 11 percent and increase the height by 16 percent. They want to model the new volume based on the radius and height of the original cans.*

- A.  $k = 0.91884$
- B.  $k = 0.00194$

- C.  $k = 0.00608$
- D.  $k = 2.88661$
- E. None of the above.

- 
17. For the scenario below, find the variation constant  $k$  of the model (if possible).

*In an alternative galaxy, the quartic of the time,  $T$  (Earth years), required for a planet to orbit Sun  $\chi$  decreases as the cube of the distance,  $d$  (AUs), that the planet is from Sun  $\chi$  decreases. For example, when Ea's average distance from Sun  $\chi$  is 2, it takes 86 Earth days to complete an orbit.*

- A.  $k = 6837602.000$
- B.  $k = 437606528.000$
- C.  $k = 4.028$
- D.  $k = 2.417$
- E. Unable to compute the constant based on the information given.

- 
18. Choose the model type that would best describe the scenario below.

*Social distancing is a common tactic to counter potential epidemics. This is due to the exponential increase in number of people infected as the density of people living in an area increases.*

- A. Direct variation
- B. Joint variation
- C. Indirect variation
- D. None of the above

- 
19. A town has an initial population of 50000. The town's population for the next 9 years is provided below. Which type of function would be



most appropriate to model the town's population?

Year	1	2	3	4	5	6	7	8	9
Pop	49978	49966	49938	49926	49898	49886	49858	49846	49818

- A. Linear
- B. Non-Linear Power
- C. Exponential
- D. Logarithmic
- E. None of the above

- 
20. A town has an initial population of 70000. The town's population for the next 9 years is provided below. Which type of function would be most appropriate to model the town's population?

Year	1	2	3	4	5	6	7	8	9
Pop	70000	69972	69956	69944	69935	69928	69922	69916	69912

- A. Logarithmic
- B. Exponential
- C. Linear
- D. Non-Linear Power
- E. None of the above

- 
21. For the scenario below, model the rate of vibration (cm/s) of the string in terms of the length of the string. Then determine the variation constant  $k$  of the model (if possible). The constant should be in terms of cm and s.

*The rate of vibration of a string under constant tension varies based on the type of string and the length of the string. The rate of vibration of string  $\omega$  increases as the square length of the string decreases. For example, when string  $\omega$  is 2 mm long, the rate of vibration is 34 cm/s.*

- A.  $k = 136.00$

- B.  $k = 1.36$
  - C.  $k = 850.00$
  - D.  $k = 8.50$
  - E. None of the above.
- 

22. Choose the model type that would best describe the scenario below.

*In economics, there are two common equations to model interest earned. The compound interest formula is  $A = P(1 + \frac{r}{n})^{nt}$ , where  $A$  is the amount of money you end up with,  $P$  is your starting money,  $r$  is the interest rate,  $n$  is the number of times compounded in a year, and  $t$  is the total number of years. For example, if you were a parent and wanted to save \$10,000 in 3 years-time at 3.5% interest compounded monthly, you would need to invest about \$9,000.*

- A. Indirect variation
  - B. Direct variation
  - C. Joint variation
  - D. None of the above
- 

23. For the scenario below, find the variation constant  $k$  of the model (if possible).

*In an alternative galaxy, the square of the time,  $T$  (Earth years), required for a planet to orbit Sun  $\chi$  increases as the cube of the distance,  $d$  (AUs), that the planet is from Sun  $\chi$  increases. For example, when Ea's average distance from Sun  $\chi$  is 2, it takes 78 Earth days to complete an orbit.*

- A.  $k = 48672.000$
- B.  $k = 7.010$
- C.  $k = 760.500$
- D.  $k = 4.028$

E. Unable to compute the constant based on the information given.

---

24. For the scenario below, use the model for the volume of a cylinder as  $V = \pi r^2 h$  to find the coefficient for the model of the new volume  $V_{\text{new}} = k r^2 h$ .

*Pepsi wants to increase the volume of soda in their cans. They've decided to decrease the radius by 15 percent and decrease the height by 10 percent. They want to model the new volume based on the radius and height of the original cans.*

- A.  $k = 0.00707$
  - B.  $k = 0.65025$
  - C.  $k = 0.00225$
  - D.  $k = 2.04282$
  - E. None of the above.
- 

25. For the scenario below, model the rate of vibration (cm/s) of the string in terms of the length of the string. Then determine the variation constant  $k$  of the model (if possible). The constant should be in terms of cm and s.

*The rate of vibration of a string under constant tension varies based on the type of string and the length of the string. The rate of vibration of string  $\omega$  increases as the square length of the string decreases. For example, when string  $\omega$  is 4 mm long, the rate of vibration is 23 cm/s.*

- A.  $k = 143.75$
  - B.  $k = 368.00$
  - C.  $k = 3.68$
  - D.  $k = 1.44$
  - E. None of the above.
-

26. For the scenario below, use the model for the volume of a cylinder as  $V = \pi r^2 h$  to find the coefficient for the model of the new volume  $V_{\text{new}} = kr^2 h$ .

*Pepsi wants to increase the volume of soda in their cans. They've decided to decrease the radius by 18 percent and decrease the height by 10 percent. They want to model the new volume based on the radius and height of the original cans.*

- A.  $k = 0.00324$
- B.  $k = 0.60516$
- C.  $k = 1.90117$
- D.  $k = 0.01018$
- E. None of the above.

- 
27. For the scenario below, find the variation constant  $k$  of the model (if possible).

*In an alternative galaxy, the cube of the time,  $T$  (Earth years), required for a planet to orbit Sun  $\chi$  increases as the cube of the distance,  $d$  (AUs), that the planet is from Sun  $\chi$  increases. For example, when Ea's average distance from Sun  $\chi$  is 3, it takes 58 Earth days to complete an orbit.*

- A.  $k = 7226.370$
- B.  $k = 5268024.000$
- C.  $k = 2.684$
- D.  $k = 4.028$
- E. Unable to compute the constant based on the information given.

- 
28. Choose the model type that would best describe the scenario below.

*Social distancing is a common tactic to counter potential epidemics. This is due to the exponential increase in number of people infected as*

*the density of people living in an area increases.*

- A. Indirect variation
- B. Joint variation
- C. Direct variation
- D. None of the above

- 
29. A town has an initial population of 70000. The town's population for the next 9 years is provided below. Which type of function would be most appropriate to model the town's population?

Year	1	2	3	4	5	6	7	8	9
Pop	70040	70080	70120	70160	70200	70240	70280	70320	70360

- A. Logarithmic
- B. Linear
- C. Exponential
- D. Non-Linear Power
- E. None of the above

- 
30. A town has an initial population of 40000. The town's population for the next 9 years is provided below. Which type of function would be most appropriate to model the town's population?

Year	1	2	3	4	5	6	7	8	9
Pop	39880	39640	38920	36760	30280	10840	0	0	0

- A. Logarithmic
- B. Non-Linear Power
- C. Linear
- D. Exponential
- E. None of the above